

10. MIOCENE CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY OF DEEP SEA DRILLING PROJECT HOLE 521A (SOUTHEAST ATLANTIC)¹

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ABSTRACT

The middle/lower upper Miocene coccolith biostratigraphy of Cores 12 and 13 in Hole 521A is given, and the reasons for the absence of *Helicosphaera* and *Sphenolithus* in most of the interval studied are speculated upon.

The lowest occurrence of *Catinaster coalitus*, which defines the base of NN8 in Magnetostratigraphic Chron C-5, confirms the observations made at Site 519 and at Hole 521 and suggests that the numerical age of NN8 is younger than previously supposed (see Hsü et al., this vol.).

BIOSTRATIGRAPHY

Smear slides of calcareous nannofossils of Cores 12 and 13 of DSDP Hole 521A from the Mid-Atlantic Ridge in the South Atlantic were studied in detail to date the samples used for the paleomagnetic studies performed by Heller et al. (this vol.) and summarized by Hsü et al. (Site 521 chapter, this vol.). The results are presented in Table 1; the age interpretation in the figure was based on the coccolith zonation of Martini (1971). The lowermost part of Core 13 can be assigned to the *Sphenolithus heteromorphus* zone (NN5) because of the presence of the name-giving species and the absence of *Helicosphaera ampliaperta*. Actually the absence of *H. ampliaperta* in an assemblage that lacks helicosphaerids altogether is likely to be due to paleoenvironmental reasons rather than to the extinction of the species and therefore should not be used for the zonal assignment at Site 521. Nevertheless, since *S. heteromorphus* extends down to the lowermost sample acquired (Sample 521-21, CC), and since this sample also contains *H. carteri* and *H. euphratis* but not *H. ampliaperta* (Percival, this vol.), the assignment to NN5 of the uppermost samples that contain *S. heteromorphus* seems justified. *S. heteromorphus* is quite common in Samples 521A-13-3, 108 cm and 521A-13-3, 46 cm, whereas only very rare, poorly preserved specimens were found in Samples 521A-13-2, 144 cm and 521A-13-3, 104 cm. From Sample 521A-13-2, 87 cm through 521A-12, CC (3 cm) the sequence is assigned to NN6/NN7, a combined *Discoaster exilis/D. kugleri* zone, since no typical specimens of *D. kugleri* were found. Some specimens similar to *D. kugleri* occur sporadically from the base through the top of the interval. Within this interval the change of dominance within the family of the Prinsiaaceae from *Cycl-cargolithus floridanus* to *Reticulofenestra pseudoumbilica* (or a predecessor of *R. pseudoumbilica*, depending

on the species concept used) can be observed between Samples 521A-13-1, 86 cm and 521A-13-1, 81 cm, only about 100 cm below the level of disappearance of *C. floridanus*. As one proceeds upsection, *Discoaster variabilis* and *D. challengeri* increase, and *D. exilis* decreases, in abundance.

The lowermost *Catinaster coalitus* appears in Sample 521A-12-3, 17 cm, where the species is very rare but is taken to mark the base of NN8, the *C. coalitus* zone. Heller et al. (this vol.) could show that this datum falls within Magnetostratigraphic Chron C-5, suggesting a numerical age considerably younger than previously assumed (Hsü et al., this vol.). The abundance of *C. coalitus* increases, and it is more common than the other species of the genus, *C. calyculus*, up to Sample 521A-12-2, 15 cm. Above this level *C. calyculus* becomes more common, and its uppermost occurrence is in Sample 521A-12-1, 90 cm, where it is very rare. The two species are usually found together in the upper part of NN8 and in NN9, and *C. calyculus* reaches halfway up into NN10, the *D. calcaris* zone. For a better subdivision of the interval according to the Martini zonation, the presence of *D. hamatus*, which defines Zone NN9, would be necessary. Only one specimen of *D. hamatus* was found, in Sample 521A-12-2, 15 cm, and the assignment of this sample to NN9 thus is not beyond doubt.

Dissolution is evident in most samples and went so far as to leave Sample 521A-13-1, 48 cm barren of calcareous nannofossils. While some discoasters show heavy overgrowth, others seem little affected by either dissolution or overgrowth. It should be interesting to establish a detailed curve of the CaCO₃ content for the middle Miocene. Comparisons with dissolution data in other South and North Atlantic sites could be established on the basis of the following coccolith events: the HO (highest occurrence) of *S. heteromorphus*, the dominance change from *Cyclicargolithus floridanus* to *R. pseudoumbilica*, the LO (lowest occurrence) of *Catinaster coalitus*, the LO of *C. calyculus*, the change in dominance from *C. coalitus* to *C. calyculus*, the HO of *C. coalitus*, and the HO of *C. calyculus*.

¹ Hsü, K. J., LaBrecque, J. L., et al., *Init. Repts. DSDP*, 73: Washington (U.S. Govt. Printing Office).

dissolution and is known from younger sediments of many areas.

The absence of any species of *Helicosphaera* is equally remarkable, since the specimens of *Helicosphaera* are not especially prone to dissolution either, and *H. carteri*, at least, is usually found in the interval studied. Do we have to explain the temporary absence of sphenoliths and/or *Helicosphaera* by the location of Site 521 on the relatively young Mid-Atlantic Ridge? Did the surface-water conditions during this time in the central South Atlantic prevent sphenoliths and *Helicosphaera* from living there? And what allowed *Helicosphaera* to become abundant later on in the Pliocene and Pleistocene? *H. carteri* appears in live samples and in sediment samples from the Atlantic (McIntyre and Bé, 1967), but its dis-

tribution gives no answers as yet. *H. carteri* and related forms are known from the early Miocene and still live today, and their distribution may provide information about paleoenvironments once we understand the reasons for their presence and absence.

REFERENCES

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